

**EFFECT OF PRECIPITATING AGENT ON THE  
CATALYTIC ACTIVITY OF  $\text{Fe}_{3-x}\text{Co}_x\text{O}_4$  CATALYST**

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## **AUTHOR'S DECLARATION**

I declare that the work in the thesis was carried out in accordance with the regulation of Universiti Teknologi MARA. It is original and is the results of my own, unless otherwise indicated or acknowledge as reference work.

I, hereby acknowledge that I have been supplied with the Academic Rules and Regulations, Universiti Teknologi MARA, regulating the conduct of my study and research.

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## SUPERVISOR'S CERTIFICATION

We declared that we read this thesis and in our point of this thesis is qualified in terms of scope and quality for the purpose of awarding the Bachelor of Chemical Engineering (Environment) with Honours.

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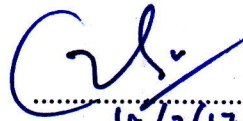


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## ABSTRACT

This research work focuses on the investigation on effect of precipitating agent on the catalytic activity of  $\text{Fe}_{3-x}\text{Co}_x\text{O}_4$ . The catalyst is synthesized by co-precipitation method where using two (2) different precipitating agents i.e. sodium hydroxide (NaOH) act as a strong base and ammonium hydroxide ( $\text{NH}_4\text{OH}$ ) act as a weak base. Precipitation agent plays a key role in precipitating the resultant catalyst, which in turn will lead to different in physico-chemical properties of  $\text{Fe}_{3-x}\text{Co}_x\text{O}_4$  catalyst. The oxidative degradation of the AO7 is performed using heterogeneous Fenton-like reaction in order to evaluate the catalytic activity of synthesized catalyst. The physical properties of resultant  $\text{Fe}_{3-x}\text{Co}_x\text{O}_4$  catalyst were characterized using  $\text{N}_2$  sorption and XRD respectively. The results of catalytic and adsorption test shown catalytic test have higher yield of degradation in AO7 dye due to the presence of active  $\bullet\text{OH}$  radicals from the decomposition of  $\text{H}_2\text{O}_2$ . Nanoparticles of  $\text{Fe}_{3-x}\text{Co}_x\text{O}_4$  lead to a dense structure when the molarity of the bases increased. The pore size at 1M, 3M and 5M of  $\text{Fe}_{3-x}\text{Co}_x\text{O}_4$  ( $\text{NH}_4\text{OH}$ ) were 6.41 nm, 3.08 nm and 3.06 nm respectively whereas for  $\text{Fe}_{3-x}\text{Co}_x\text{O}_4$  (NaOH) were 8.22 nm, 8.15 nm, 8.49 nm respectively as formed with 1M, 3M and 5M. XRD characterization was carried out to determine the phase purity of  $\text{Fe}_{3-x}\text{Co}_x\text{O}_4$  catalysts. The orientation of the particles in the catalyst has a strong effect on the intensities where sometimes the particles are needles or plateles that are somewhat aligned. A low shape peak indicates the particles were randomly oriented and the missing of cobalt ferrite phase in XRD patterns at NaOH due to an even dispersion of  $\text{Co}^{2+}$  species and clusters finely dispersed on the cobalt ferrite. However, as for 1M of  $\text{NH}_4\text{OH}$  there was only iron oxide was formed without any other impurities due to the tendency of  $\text{NH}_4\text{OH}$  to produce agglomeration was very high. Thus, the  $\text{Co}^{2+}$  substitution was not presence in the iron oxide itself. As a conclusion, it is shown that strong base was better in synthesizing the catalyst compared to the weak base in order to obtain a better degradation of dye and a better substitution of  $\text{Co}^{2+}$  ion to enhance the catalytic activity.